

**MIDWEST CENTER FOR OCCUPATIONAL HEALTH AND SAFETY  
EDUCATION AND RESEARCH CENTER**

**SUMMARY ANNUAL REPORT  
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**SUBMITTED BY:**

**SUSAN GOODWIN GERBERICH, PHD, MSPH, CENTER DIRECTOR  
PATRICIA M. MCGOVERN, PHD, MPH, RN, DEPUTY DIRECTOR**

**DIVISION OF ENVIRONMENTAL HEALTH SCIENCES,  
SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF MINNESOTA  
MINNEAPOLIS, MINNESOTA 55455**

**UNIVERSITY OF MINNESOTA**  
**MIDWEST CENTER FOR OCCUPATIONAL HEALTH AND SAFETY (MCOHS)**  
**EDUCATION AND RESEARCH CENTER (ERC)**

**SECTION I:**

**Summary**

The mission of the Midwest Center for Occupational Health and Safety (MCOHS) Education and Research Center (ERC) is to ensure a Center of Excellence that provides: 1) cutting-edge interdisciplinary academic and research training to prepare exceptional leaders who make significant contributions to the field of occupational health and safety, and (2) continuing education to prepare professionals in the field to address current and emerging threats to the nation's workforce. This ERC was established over 30 years ago in response to a mandate of the National Institute for Occupational Safety and Health (NIOSH) -- to provide an adequate supply of qualified personnel to carry out the purposes of the Occupational Safety and Health Act and reduce the national burden of work-related injury and illness. Recognized regionally, nationally and internationally, the MCOHS serves the region of Minnesota, Wisconsin, North Dakota, and South Dakota and is a resource for industry, labor, federal, state, and local government agencies, agriculture, and other interested parties. Excellence is provided in key academic graduate degree programs: Industrial Hygiene; Occupational and Environmental Medicine; Occupational and Environmental Health Nursing; Occupational Health Services Research and Policy; Occupational Injury Prevention Research Training; and Occupational and Environmental Epidemiology. The Continuing Education Program offers novel courses to meet the needs of a diverse workforce. An innovative administrative structure supports enhanced efforts in interdisciplinary research, education, and outreach, including research-to-practice (r2p) and strengthens diversity recruitment. Implementation of strategic planning efforts further strengthen this Center with focused involvement of key stakeholders to ensure the Center is positioned to continue to produce the leaders who make important contributions to the safety and health of the nation's workforce ([www.mcohs.umn.edu](http://www.mcohs.umn.edu)).

**Relevance**

The MCOHS ERC serves the region of Minnesota, Wisconsin, North Dakota and South Dakota – and beyond -- and is a resource for industry, labor, federal, state, and local government agencies, agriculture, and other interested parties. Recognized regionally, nationally, and internationally, it provides outstanding graduate academic and research training programs and innovative Continuing Education programs to ensure the Center is positioned to continue to produce the leaders who make important contributions to occupational safety and health by reducing the burden of injury and illness.

**Key Personnel**

**Principal Investigator/Director:**

*Susan Goodwin Gerberich, PhD, Mayo Professor and*  
*Leon S. Robertson Professor in Injury Prevention*  
Telephone: 612-625-5934  
Email: [gerbe001@umn.edu](mailto:gerbe001@umn.edu)

**Deputy Director:**

*Patricia M. McGovern, PhD, MPH, RN, Professor*  
Telephone: 612-625-7429  
Email: [pmcg@umn.edu](mailto:pmcg@umn.edu)

**Associate Dean for Education**

*Debra Olson, MPH, DNP, Professor*  
Telephone: 612-625-0476  
Email: [olson002@umn.edu](mailto:olson002@umn.edu)

**Director – Research/Pilot Projects**

*Gurumurthy Ramachandran, PhD, Professor*  
Telephone: 612-626-5428

Email: [ramac002@umn.edu](mailto:ramac002@umn.edu)

### **Co-Directors - Academic Training**

*Bruce H. Alexander, PhD, Professor*

Telephone: 612-625-7934

Email: [balex@umn.edu](mailto:balex@umn.edu)

*Jeffrey Mandel, MD, MPH, Associate Professor*

Telephone: 612-626-9308

Email: [mand0125@umn.edu](mailto:mand0125@umn.edu)

### **Director – Outreach**

*Ruth Rasmussen, MS, MPH, Director of Continuing Education*

Telephone: 612-625-8836

Email: [rasmu048@umn.edu](mailto:rasmu048@umn.edu)

### **Diversity Advisor**

*Rickey Hall, Assistant Vice-President*

Office of Equity and Diversity, University of Minnesota

Telephone: 612-624-0594

Email: [hallrl@umn.edu](mailto:hallrl@umn.edu)

### **Co-Program Managers**

*Andrew Ryan, MS, Senior Research Fellow*

Telephone: 612-625-1443

Email: [ryanx029@umn.edu](mailto:ryanx029@umn.edu)

*Nancy Nachreiner, PhD, Assistant Professor*

Telephone: 612-625-2487

Email: [nachr001@umn.edu](mailto:nachr001@umn.edu)

### **Fiscal Officer/Accountant**

*Debb Grove*

Telephone: 612-626-4803

Email: [grove020@umn.edu](mailto:grove020@umn.edu)

### **Industrial Hygiene**

#### **Program Director**

*Gurumurthy Ramachandran, PhD, CIH, Professor*

Telephone: 612-626-5428

Email: [ramac002@umn.edu](mailto:ramac002@umn.edu)

Website: <http://www.mcohs.umn.edu/academics/ih/introduction.html>

### **Occupational and Environmental Medicine**

#### **Academic Program Director**

*Jeffrey H. Mandel, MD, MPH, Associate Professor*

Telephone: 612-626-9308

Email: [mand0125@umn.edu](mailto:mand0125@umn.edu)

Website: <http://www.mcohs.umn.edu/academics/oem/introduction.html>

### **Occupational and Environmental Health Nursing**

#### **Program Co-Directors**

*Patricia M. McGovern, PhD, MPH, RN, Professor*

Telephone: 612-625-7429

Email: [pmcg@umn.edu](mailto:pmcg@umn.edu)

*Nancy M. Nachreiner, PhD, MPH, RN, COHN-S, Assistant Professor*

Telephone: 612-625-2487

Email: [nachr001@umn.edu](mailto:nachr001@umn.edu)

Website: <http://www.mcohs.umn.edu/academics/oehn/introduction.html>

### **Occupational Injury Prevention Research Training Program**

#### **Program Co-Directors**

Susan Goodwin Gerberich, PhD, Mayo Professor and  
Leon S. Robertson Professor in Injury Prevention

Telephone: 612-625-5934

Email: [gerbe001@umn.edu](mailto:gerbe001@umn.edu)

Bruce Alexander, PhD, Professor

Telephone: 612-625-7934

Email: [balex@umn.edu](mailto:balex@umn.edu)

Website: <http://www.mcohs.umn.edu/academics/oiprt/introduction.html>

### **Occupational Health Services Research and Policy**

#### **Program Co-Directors:**

Patricia M. McGovern, PhD, RN, Professor

Telephone: 612-625-7429

Email: [pmcg@umn.edu](mailto:pmcg@umn.edu)

Bryan Dowd, PhD, Professor

Telephone: 612-624-5468

Email: [dowdx001@umn.edu](mailto:dowdx001@umn.edu)

Website: <http://www.mcohs.umn.edu/academics/ohsrp/introduction.html>

### **Occupational and Environmental Epidemiology**

#### **Program - Director:**

Bruce H. Alexander, PhD, Professor

Telephone: 612-625-7934

Email: [balex@umn.edu](mailto:balex@umn.edu)

#### **Program – Co-Directors:**

Richard F. MacLehose, PhD, Assistant Professor

Email: [macl0029@umn.edu](mailto:macl0029@umn.edu)

Jeffrey H. Mandel, MD, MPH, Associate Professor

E-mail: [mand0125@umn.edu](mailto:mand0125@umn.edu)

Website: [In progress](#)

### **Hazardous Substances Academic Training**

#### **Program - Director:**

Peter C. Raynor, PhD, Associate Professor

Telephone: 612-625-7135

Email: [praynor@umn.edu](mailto:praynor@umn.edu)

### **Continuing Education in Occupational Health and Safety**

#### **Program Director:**

Ruth Rasmussen, RN, MS, MPH

Telephone: 612-625-8836

Email: [rasmu048@umn.edu](mailto:rasmu048@umn.edu)

Website: [http://www.mcohs.umn.edu/continuing\\_education/index.html](http://www.mcohs.umn.edu/continuing_education/index.html)

ERC web link: [www.mcohs.umn.edu](http://www.mcohs.umn.edu)

## **SECTION II:**

### **Program Highlights of High Impact**

#### **A. Industrial Hygiene**

##### **Program Director**

Gurumurthy Ramachandran, PhD, CIH, Professor

##### **1. Exposure Assessment in the Taconite Industry**

Drs. Ramachandran and Raynor and PhD students Jooyeon Hwang and Tran Huynh have conducted comprehensive measurements of personal exposures to elongated mineral particles (EMPs), and respirable dust and silica in six taconite mines in northeastern Minnesota in this project funded by the State

of Minnesota. The results are also being used for an epidemiological study of mesothelioma, lung cancer, and silicosis in taconite workers. This proposal is relevant to the Mining sector of the National Occupational Research Agenda (NORA). It also addresses several of the priority Cross-sector research areas: exposure assessment; mixed exposures; respiratory disease; and epidemiology. The aims of this research are also key goals of the NIOSH Roadmap for Research relating to asbestos fibers and other EMPs (NIOSH, 2011) and will have impact at the national as well as regional levels: a) develop a broader and clearer understanding of the important determinants of toxicity for non-asbestiform EMPs, including dimensional attributes (length, width and aspect ratio); b) develop information on occupational exposures to various EMPs and associated health risks; c) enhance the understanding of different exposure metrics and their impact on disease measurement; d) evaluate the risk of specific disease in relation to these exposures.

## **2. A Randomized Intervention in Auto Collision Repair Shops**

This NIOSH-funded RO1 study is in its final year of five years. The purpose of the research was to evaluate the effectiveness of a randomized intervention designed to reduce exposure to diverse hazards among workers in small auto collision repair shops (Standard Industrial Classification Code 7532). Interventions include: a) a tailored shop improvement plan; b) quarterly telephone contacts; c) program development; d) assistance with OSHA grant preparation; e) on-line employee training to meet right-to-know regulatory requirements; f) on-line respirator medical surveillance; g) respirator fit testing; h) in-person assistance with shop improvements; i) baseline and follow-up shop audits; j) on-line safety program and policy resources; and k) newsletters. The primary hypothesis of this study is that the availability and use of environmental and administrative controls and personal protective equipment will be greater, and exposure to physical and chemical hazards will be lower, after a comprehensive intervention implemented by owners and workers compared with a minimal intervention. The study utilizes owner and worker auditing of the shop environment, the development of worker/owner health and safety goals and action plans, and periodic assessment of progress towards meeting these goals. Industry representatives and community-based partners provide technical support and serve on a study Advisory Board. A randomized controlled trial with two groups was used to test intervention effectiveness. Fifty shops were randomly assigned to each group. Intervention mapping served as the planning model and Social Cognitive Theory served as the behavioral model. Study outcomes are: a) A change in shop hazard score between baseline and two follow-up periods; b) Changes in owner and worker knowledge and beliefs with regard to shop safety and hazard recognition; and c) Qualitative measures including process evaluation, interviews, and focus groups. Shops were evaluated at baseline (t1), nine months (t2), and 18 months (t3). After their second evaluation (t2), control shops were enrolled as intervention shops. This research addresses the needs of a large community of workers and owners of underserved business establishments and has national implications. New methods are needed to reach the community of owners and workers in small business establishments. These methods account for limited financial resources, geographically dispersed work sites, the wide range of knowledge among owners and workers, and the variability of site-specific health and safety programs. This approach allows for the affected community to be actively engaged in identifying problems and solutions, participate in the dissemination of health and safety programs, and assure new programs may be sustained on a long-term basis through trade associations, and community-based technical training programs.

## **3. Effects of Spray Surfactant and Particle Charge on Respirable Dust Control**

PhD student Mei Wang is working with Dr. Raynor on a project with the objective to determine if sprays with surfactants having different ionic properties capture respirable dust particles carrying certain levels and sign of charge more effectively than particles charged differently. The long-term goal of this line of research is to reduce respirable dust concentrations in underground coalmines by improving engineering control technology. The objective of this specific project is to measure how efficiently sprays containing different types and concentrations of surfactants collect laboratory-generated aerosol particles carrying various levels of electrical charge. The objective is being achieved by accomplishing the following three specific aims: a) Design and build a test apparatus to measure the ability of sprays to collect airborne particles; b) Measure the spray collection efficiency for polystyrene latex (PSL) spheres using several spray surfactants; and c) Measure the spray collection efficiency for a polydisperse coal dust using several spray surfactants.

Results, thus far, show that particle diameter is a more important determinant of spray collection efficiency than particle charge or spray surfactant type or concentration. Nonetheless, surfactant type and

concentration may affect collection efficiency significantly. In particular, particles that are strongly charged may be collected much more efficiently than they would otherwise by surfactant sprays that carry an opposite. The expected outcome of the proposed research will be a set of recommendations for surfactant types that can be used most successfully in sprays to enhance capture of respirable coal dust particles that carry specific signs and magnitudes of charge. The data generated in this study have national implications and will assist mine operators in making informed decisions about the type of surfactant to use in spray systems to maximize dust capture, depending on the characteristics of the coal being mined.

#### **4. Measurement of Particle Sizes Associated with Airborne Viruses**

Dr. Raynor is working with colleagues on a project to find optimal ways to measure the particle sizes with which live airborne viruses are associated. The long-range goal of this line of research is to find ways to minimize the transmission of infectious viruses through air to people working in professions at risk. To determine what technologies and procedures will be most effective at reducing the transmission of virus-containing particles, we must know the size of particles with which viruses are associated. Therefore, the objectives of the proposed research are to develop and validate a method to determine virus concentration in air as a function of particle size and to use the method to measure the particle sizes with which airborne viruses are associated in occupational settings.

Thus far, we have used non-viable impactors to successfully sample six different viruses in laboratory tests. In addition, we have sampled influenza viruses in swine production operations, with limited success keeping the viruses live. Further lab research suggests that size separation followed by collection on dissolvable gelatin filters may keep the virus live longer than collection by impaction will. Critically important knowledge will be gained when a method is developed to measure the particle sizes with which viruses are associated, and that task is the subject of this proposal. In particular, we will understand how far infectious airborne viruses can be transmitted, how deeply into the lungs they may be inhaled, and how to control airborne exposures to the viruses most effectively.

#### **5. Respiratory Protection Programs in Acute Care Hospitals**

This NIOSH-funded project is a collaboration with the University of Illinois Chicago to evaluate respiratory protection programs in acute care hospitals in Minnesota and Illinois, which will have a regional impact. The goals are to: a) compare written respiratory protection programs and hospital interview data among hospitals, b) compare respiratory protection policies to respiratory protection implementation in acute care hospitals in Illinois and Minnesota, and c) compare hospital manager, unit manager, and healthcare worker knowledge of respiratory protection procedures in Illinois and Minnesota. The project also examined the relation between safety climate (SC) measures and location (Minnesota or Illinois), demographic characteristics of participants, type of employee and participants' responses about fit testing, and medical clearance and training; 15 hospitals in Minnesota and 13 hospitals in Illinois were recruited to participate in the second Respiratory Protection in Acute Care Hospitals study (REACH II). Written respiratory protection programs were collected from each hospital as well as interview responses from hospital managers (HM; n=88), unit manager (UM; n=82), and healthcare workers (HCW; n=364).

### **B. Occupational and Environmental Medicine**

#### **Academic Program Director**

Jeffrey H. Mandel, MD, MPH, Associate Professor

The following research areas were completed as of June, 2012:

#### **1. On-Site Exposure Assessment**

Over 2000 personal and area samples have been completed in all six active mines in Northern Minnesota (Collaborative Effort: Refer to Industrial Hygiene report, Project #1).

#### **2. Environmental Characterization of Dust in the Communities**

Characterization of dusts in communities that are in close proximities to the active mines in Northern Minnesota has been completed. This included longitudinal sampling from a dozen sites in communities across Minnesota's iron range as well as analyses of sediments from lakes in close proximities to some mines. This sampling included analyses of particles in the near-nano size range. This investigation has the impact for better understanding community exposures that are generated from mining activities.

#### **3. Respiratory Health Survey of Current and Former Workers and Spouses**

Through this survey, over 1800 individuals were screened, including 1300 current and former workers and 500 spouses. The evaluation included a comprehensive work and medical history questionnaire, chest x-rays, spirometry, diffusion lung capacity and alveolar volume testing. Detailed exposure information is currently being incorporated into assessments of test findings in workers and spouses. Insights will be obtained into the relationship of elongated mineral particle (EMP), silica and respirable dust exposures and lung anatomy (defined by chest x-ray) and physiological function as measured by spirometry, DLCO and alveolar volume. This investigation is important to the understanding of these tests results relative to EMP exposures between 200 nanometers and 2 microns in length. This sized EMP exposure has not been well-characterized in the taconite mining industry. Insight into these relations follows the NIOSH Roadmap in terms of the development of a broader understanding of the determinants of toxicity for EMPs. Findings are expected to have regional and national impact in terms of understanding exposure-disease relations.

#### **4. General Mortality Assessment of Workers in Minnesota's Taconite Industry**

A mortality study of workers in the industry born on or after 1920 has been completed. Causes of death have been categorized with subsequent standardized mortality ratios (SMRs), determined for some 46,000 individuals who worked in the industry since its inception in the 1950s. The mortality experience of this cohort was last assessed some 20 years ago and only within single companies. This assessment will impact regional and national knowledge about the death experience for workers in this industry because of the cohort size and the length of time since exposure, both of which make this investigation more robust than earlier studies.

#### **5. Epidemiologic Investigation of Mesotheliomas and Lung Cancers in Taconite Miners**

Through the Minnesota state's cancer registry and by death certificate evaluation, researchers have identified 80 cases of Mesothelioma in a cohort of Minnesota taconite workers. Using nested case-control study methods, an assessment of the relation between workplace exposures and health outcomes is being made. This assessment is expected to be completed in late 2012-early 2013. Some 1800 lung cancer cases have also been identified in the same manner, within the Taconite cohort. Case-control study methods are also being used to assess the role of workplace exposures in the case group. In both studies, exposures to elongated mineral particle (EMP), silica and respirable dust are being assessed. Lung cancer findings will be categorized within four tissue types, since the state's cancer registry is based on histological information. These assessments will impact regional and national understanding of disease risk associated with a spectrum of EMP exposures, in combination with silica and respirable dust exposures. The study findings will also impact and support the NIOSH Roadmap for Research.

### **C. Occupational and Environmental Health Nursing**

#### **Program Co-Directors**

Patricia M. McGovern, PhD, MPH, RN, Professor

Nancy M. Nachreiner, PhD, MPH, RN, COHN-S, Assistant Professor

#### **1. Return on Investment for Occupational Health Nurses' Contributions to Worker Health**

Catherine Graeve, RN, MPH (PhD trainee) developed an online tool to estimate the return on investment for employers using Occupational Health Nursing services to protect and promote worker health and safety. This applied research project was conducted under the supervision of Drs. McGovern and Nachreiner, and Lynn Ayers, MPH, RN, Director, Northworks Business Health, and OEHN alumnae and internship preceptor. This research addresses the NORA cross-sector research area of economics. Although the professional literature supports the importance of using a quantitative tool to assess and report the economic contribution of Occupational Health Nursing Services, a standard mechanism does not exist. There are software applications and systems that can be purchased, making them out of reach for some small businesses. This research created and pilot-tested one approach to creating a measurement tool for a small consulting company. The tool was created in eMicrosoft Excel (2010) using several worksheets to estimate cost savings associated with specific OEHN services such as the avoidance of a worker's visit to an external, local clinic by using onsite OHENs to provide employee care, or the value of employee time saved when an OEHN provides disability management services that promote employee health and restore function, thus, shortening time off work relative to published condition-specific disability maximums. A poster, "Development of a Return on Investment Tool: Establishing the Value of Occupational Health Nurses' Contributions to Worker Health and Safety," was presented by Ms. Graeve, at the 2012 American Association of Occupational Health Nurses (AAOHN) Conference held in Nashville,

Tennessee April 22-25, 2012 and awarded second place in the poster category for Practice; an associated manuscript is in review.

## **2. Assessing Perceived Pesticide Exposures among Caregivers to Young Children**

Drs. McGovern and Alexander (OEE) and PhD student, Maggie Stedman Smith (OEHN trainee) collaborated with the University of Minnesota's Regional Sustainable Development Partnership to develop and implement a needs assessment of perceived pesticide exposures among mothers and grandmothers of young children in Minnesota's Red River Valley. This research addressed the NORA research sector of agriculture, forestry and fishing. The research team employed Photovoice as a method for the mothers to document their concerns with digital cameras and create a photography exhibit to communicate their needs to decision-makers. Study findings revealed the need for a pesticide education program to be delivered by public health nurses serving parents of young children that can address concerns about pesticide exposures, including aerial spraying, mosquito fogging, use and storage of pesticides, and effects on fetal and child health. A subsequent intervention grant led to the development of the curriculum initiative and, to date, 27 public health nurses have participated in the program with outreach to ~ 600 families in the region. Ruth Rasmussen, Director of MCOHS Continuing Education and Dr. Heidi RoeberRice, Occupational Medicine physician, are collaborating with the Regional Sustainable Development Partnership on this second phase of the project. (See <http://www.regionalpartnerships.umn.edu/<select>Northwest>; <http://redriverkids.blogspot.com/Growing Up Health in the Red River Valley>, and Stedman-Smith, McGovern, Peden-McAlpine, Kingery and Drager. Photovoice in the Red River Basin of the North: A Systematic Evaluation of a Community-Academic Partnership, Health Promotion Practice, 2012;13( 5): 599-607, and a forthcoming paper by Stedman-Smith, McGovern, Peden-McAlpine. Mothers' Concerns about Children's Exposure to Pesticide Drift in the Red River Basin of the North: A Novel Application of Photovoice. Online Journal of Rural Nursing and Health Care, In press.)

## **3. A Mixed Methods Inquiry into the Injuries Sustained by Security Guards at a Level 1 Trauma Hospital**

Joshua Gramling, RN, MSN (OEHN PhD student) is identifying common themes and protective or risk factors for injuries occurring to security personnel while interacting with violent patients at a Level 1 Trauma Hospital. Work-related violence is a significant problem. It is estimated that security personnel in hospital settings experience injuries from workplace violence at rates two to three times that of registered nurses, though research is very limited. These pilot data will be used to guide refinement of the Mr. Gramling's dissertation topic, under the supervision of Drs. Nachreiner, McGovern, and Alexander. This research addresses the NORA Healthcare and Social Assistance Sector, and may be used for identifying future interventions to protect this group of workers. Mr. Gramling was recently named the recipient of the 2012 Association of Occupational Health Professionals in Healthcare (AOHP) Julie Schmid Research Award for this project.

## **4. Early work patterns for gynecological cancer survivors in the US.**

With over 4.3 million working-age cancer survivors in the United States, there is a critical need to understand factors that help and hinder survivors' ability to return to work during and after cancer treatment. Dr. Nachreiner has led efforts to identify changes in work status for gynecological cancer survivors during the first six-months following diagnosis and the survivors' experience with their employers' programs and policies; 110 gynecological cancer survivors who were working at the time of their cancer diagnosis completed a survey and medical record review, resulting in identification of their experiences at work during and after cancer treatment. Opportunities exist to improve communication about work and treatment expectations among cancer survivors, occupational health professionals, employers and treating clinicians. This research focus complements other research within the NIOSH Total Worker Health Program that currently explores employer support for work and family balance. Dr. Nachreiner's findings were recently published in Occupational Medicine (2012; 62:23-28).

## **D. Occupational Injury Prevention Research Training Program Program Co-Directors**

Susan Goodwin Gerberich, PhD, Mayo Professor and

Leon S. Robertson Professor in Injury Prevention

Bruce Alexander, PhD, Professor

## **1. Evaluating Injury Risk Factors and Risk Reduction Practices in the Construction Industry**



Katherine Schofield, PhD, an OIP RTP doctoral trainee working under the supervision of Drs. Alexander and Gerberich, completed a comprehensive study of injury occurring in small- and medium-sized construction firms. The construction industry is inherently hazardous with many factors leading to injury. Construction work is also notoriously difficult to study due to the changing and mobile nature of the work. This is particularly true for small- and medium-sized firms. This study evaluated the impact of a loss control program affiliated with a workers' compensation carrier. Injury rates were prospectively evaluated in relation to the application of drug and alcohol screening programs, contacts by certified safety specialists, and management attitude and commitment to safety. An additional analysis modeled the frequency of less severe injuries as a predictor of time-loss injury claims. This study was unique in its ability to prospectively evaluate the impact of injury prevention programs implemented at the company level. The study determined that drug and alcohol screening and early visits by safety professionals are potentially important means to reduce injury risk. Management attitude and commitment to safety, a factor widely considered important to injury risk, was shown to require a comprehensive assessment over time. The assessment of the more frequent, less severe injuries emerged as a potential sentinel events for more severe injuries. The results of this study will help guide research and prevention programs in the National Occupational Research Agenda Construction Industry Sector goals of Construction Culture, Construction Safety and Health Management, Construction Industry Work Organization, Training and Education, and Improving Surveillance of Hazards and Outcomes.

## **2. Incidence and Consequences of and Risk Factors for Injuries among Agricultural Household Members**

Drs. Gerberich and Alexander, team of co-investigators and students, lead major injury prevention studies that are the basis of regional research-to-practice efforts. These include surveillance studies of the incidence and consequences of, and risk factors for, agricultural and other injuries in Minnesota, Wisconsin, North and South Dakota and Nebraska. The study results and identification of intervention efforts are translated to practice through collaboration with regional Agricultural Extension leaders who work directly with operators and communities. Dissemination has also been accomplished through numerous peer-reviewed publications and presentations in local, national and international arenas. Funded by NIOSH RO1 grants, this effort addresses the Agriculture, Forestry and Fishing sector and cross-sectors of Surveillance, Exposure Assessment, and Traumatic Injury.

## **3. Violence against Nurses: The Next Step**

Identification of risk factors for work-related physical assault by Drs. Gerberich and Nachreiner, their colleagues, and PhD students, are particularly important to application of relevant interventions. These risks include working in environments with low lighting, not carrying cell phones or alarms, working in emergency and psychiatric departments and long-term care facilities, and increasing hours of patient contact. Dissemination to professionals has been accomplished through numerous peer-reviewed publications and professional presentations. A collaborative effort with NIOSH also resulted in development of an online violence prevention course for healthcare workers and others that incorporates results from this and related studies. This NIOSH RO1-Funded effort addressed the Healthcare and Social Assistance Sector and Cross-sectors of Exposure Assessment and Traumatic Injury.

## **4. Preventing Violence against Teachers/Educators**

Dr. Gerberich, research team members, and PhD students have been providing translation of research data from the Minnesota study of "Violence Against Teachers: Etiology and Consequences," to practice throughout the school systems, in collaboration with their dedicated advisory board of educators. Risk factor identification, which serves as a basis for development of relevant interventions, includes consideration of various environmental factors, assault deterrents, violence policies, and school financial resources. To date, results have been presented at numerous major professional meetings, including audiences involving teachers, and in peer-reviewed publications. Funded by a NIOSH RO1 grant, this effort addressed the Services Sector of Education and Cross-sectors of Exposure Assessment and Traumatic Injury. [Publications, to date: (1) Nachreiner NM, Gerberich SG, Ryan AD, Erkal S, McGovern PM, Church TR, Mongin SJ, Feda DM. Risk of physical assault against school educators with histories of occupational and other violence: A case-control study. *WORK: A Journal for Prevention, Assessment, and Rehabilitation* 42:39-46, 2012. (2) Gerberich SG, Nachreiner NM, Ryan AD, Church TR, McGovern PM, Geisser MS, Watt GD, Feda DM, Pinder E, Sage SK. Violence against educators: a population-based study. *Journal of Occupational and Environmental Medicine* 53(3):294-302, 2011. Erratum: *Journal of Occupational and*

*Environmental Medicine* 2011;53(5):585. (3) Feda DM, Gerberich SG, Ryan AD, Nachreiner NM, McGovern PM. Written violence policies and risk of physical assault against Minnesota educators, *Journal of Public Health Policy* 31(4):461-477, 2010. (4) Sage SK, Gerberich SG, Ryan AD, Nachreiner NM, Church TR, Alexander BH, Mongin SJ. School resources, resource allocation and risk of physical assault against Minnesota educators, *Accident Analysis and Prevention* 42(1):1-9, 2009.]

## **E. Occupational Health Services Research and Policy**

### **Program Co-Directors:**

Patricia M. McGovern, PhD, RN, Professor

Bryan Dowd, PhD, Professor

### **1. Evaluating Total Workload for New Mothers upon Return to Work**

Drs. McGovern, RoeberRice (OEM), and Dowd collaborated with PhD student, Rada Dagher and conducted a prospective study of 716 employed women to identify changes in women's health after childbirth and return to work. Panel data were collected on women's health, employment, family and individual characteristics and time use at five time periods to identify the impact of women's daily Total (paid and unpaid) Workload for 18 months after childbirth. This research is relevant to several sectors of National Occupational Research Agenda (NORA) including health care and social assistance, services, wholesale and retail trade, and manufacturing, and was made possible through a NIOSH grant (#5 R18OH003605-05). This research also addresses Cross-sector research areas: total worker health, and work organization and stress-related disorders. Study findings revealed that almost all women returned to work by one year after childbirth. Mothers in this sample had heavy Total daily Work Loads (TWL) of 14-15 hours per day of paid and unpaid work with limited sleep and personal time throughout the first 12 months after childbirth. Increased maternal TWL was significantly associated with health symptoms and poorer mental health identified through multivariate analyses, suggesting mothers' work responsibilities and conflicting role demands may increase their risk for poor health outcomes. Conversely, women's postpartum health was positively associated with social support; thus, the presence of support may help blunt the negative effects of excess work. Health care providers need to consider working in collaboration with human resource personnel and top managers to influence workplace policies to promote mothers' recovery from childbirth and successful resumption of work roles. See: McGovern, Dagher, Roeber Rice, Gjerdingen, Dowd, Ukestad, and Lundberg. *A longitudinal analysis of total workload and women's health after childbirth. JOEM, 2011, 53(5): 497-505.*

### **2. Evaluating Health Care Costs of Maternal Postpartum Depression for Employed Mothers**

Doctoral student, Rada Dagher, worked under the supervision of Drs. McGovern and Dowd to investigate the incidence and costs of postpartum depression among employed women after childbirth, using the data set described above. This research is relevant to several sectors of National Occupational Research Agenda (NORA) including health care and social assistance, services, wholesale and retail trade, and manufacturing. It also addresses several of the priority Cross-sector research areas: total worker health and work organization and stress-related disorders. Study findings revealed depressed women had consistently higher health services costs than non-depressed women. A six-fold increase in counseling visits and a four-fold increase in emergency department visits appeared to be driving the cost differences between depressed and non-depressed mothers. Higher health expenditures among postpartum depressed women highlight the importance of addressing mental health issues in the workplace. Options include occupational health providers working with employers to evaluate health plan coverage and employee access to preferred providers, using evidence-based best practices screening and treatment for depression in primary care. See: Dagher, McGovern, Dowd and Gjerdingen. *Postpartum depression and health services expenditures among employed women. JOEM, 2011, 54(2): 210-215.*

### **3. Evaluating the Impact of Postpartum Work-Family Conflict on Maternal Health**

Mira Grice, PhD, OHSRP doctoral trainee, working under the supervision of Drs. McGovern and Alexander (Occupational and Environmental Epidemiology), examined associations between work-family conflict and women's health after childbirth using the data set described above. This research is relevant to several sectors of National Occupational Research Agenda (NORA), including health care and social assistance, services, wholesale and retail trade, and manufacturing. It also addresses several of the priority Cross-sector research areas: total worker health and work organization and stress-related disorders. Study findings revealed that women who reported high levels of job spillover to home had mental health

scores slightly, but significantly, worse than women who reported low levels of spillover. Women with medium and high levels of home spillover to job also reported worse mental health relative to those with low spillover. As new mothers strive to balance employment with infant care, they will likely experience work-family conflict, in particular, job spillover to home. Further research is needed to identify the workplace and organizational factors that limit or reduce the burden associated with balancing work and family commitments for mothers and fathers. Federal and state policies should focus on development of institutional and fiscal support for employed parents of infants at a vulnerable time in the family life cycle. See: Grice, McGovern, Alexander, Ukestad, Hellerstedt, Balancing work and family after childbirth: a longitudinal analysis, *Women's Health Issues* 2011;21:19-27.

## **F. Occupational and Environmental Epidemiology**

### **Program - Director:**

*Bruce H. Alexander, PhD, Professor*

### **Program – Co-Directors:**

*Richard F. MacLehose, PhD, Assistant Professor*

*Jeffrey H. Mandel, MD, MPH, Associate Professor*

#### **1. Toward Reducing the Impact of Lung Disease in Miners**

Drs. Alexander, Mandel, and MacLehose are working with three OEE trainees, Christine Lambert, Elizabeth Allen, and Naemeka Odo on various aspects of respiratory health in current and former employees of the taconite industry. Taconite mining and milling is a major industry in Minnesota, and the industry is expanding in Wisconsin and Michigan. Though an important industry, there have long been questions about health effects related to dust from taconite. The University of Minnesota, through funding from the State of Minnesota, is conducting a thorough study of health issues in this industry. The work being carried out by the MCOHS trainees will evaluate potential associations between taconite dust and mesothelioma, lung cancer, and non-malignant pleural and parenchymal diseases. *This work is directly related to the NORA mining sector goals of reducing the impact of lung disease in miners. It will also contribute to NIOSH goals outlined in the Asbestos Fibers and Other Elongate Mineral Particles: State of the Science and Roadmap for Research document. The study particularly focuses on exposures to elongated mineral particles of various definitions.*

#### **2. Persistence of PFOA in the Work Environment and Health Effects**

Drs. Alexander and Church are working with two trainees on a study of cancer incidence and mortality in workers employed at an ammonium perfluorooctanoate production facility. This chemical dissociates to perfluorooctanoic acid (PFOA) in the biologic systems. *Potential health effects of PFOA and other fluororochemicals are of particular current interest given the pervasive nature of the exposure to people and animals around the world.* There are few opportunities to study occupational exposures of this chemistry and characterize health in people experiencing the highest exposures. A central focus of this study is developing exposure models that account for the persistent nature of the chemical in the body and evaluating exposure in age-specific windows. PFOA has a biological half-life of more than three years which can spread out the potential impact of shorter-term high exposure levels.

## **G. Hazardous Substances Academic Training**

### **Program - Director:**

*Peter C. Raynor, PhD, Associate Professor*

#### **1. Evaluating Nanoparticle Generation during Shredding of Nanocomposites for Recycling**

In May 2012, Dr. Raynor disseminated his research results through an invited presentation on the potential for the shredding of nanocomposite plastics during recycling to generate airborne nanoparticles at the conference, *Safety Issues and Regulatory Challenges of Nanomaterials* in San Sebastian, Spain. This conference was attended by researchers interested in sustainable nanotechnology from across Europe. *Important findings, presented by Dr. Raynor, indicate that polypropylene resins reinforced with nanoclay, do not have a strong potential to release the nanoclay particles into the air during the recycling process.*

#### **2) Analysis of Mouse Urinary Protein Data at University of Minnesota Research Animal Resource Facilities**

Recent MS graduate, Joe Hexum, collaborated with Dr. Raynor and staff from the University of Minnesota Department of Environmental Health and Safety on this project. The objective of the project was

to evaluate the effectiveness of ventilation control methods in reducing airborne exposures to mouse urine protein (MUP) for workers at the university who transfer mice between cages and dump the bedding from cages prior to cleaning. The study found that cage-dumping created much greater MUP exposure than transferring mice between cages. However, statistical analyses indicated that different kinds of sampling methods used for measurements were confounded with the types and locations of control measures examined so that it was impossible to identify the optimal control measures without additional measurements. *This research is being utilized by the Department of Environmental Health and Safety to optimize their sampling procedures for future measurements.*

## **H. Continuing Education in Occupational Health and Safety**

### **Program Director:**

*Ruth Rasmussen, RN, MS, MPH*

The Continuing Education (CE) Program included the Hazardous Substances Training (HST)-CE supplemental program. **TOTAL courses provided**, during the past year, for the two programs = **95 courses involving 4,480 participants [1891 participants in online modules awarding CE credit; 2589 in-person course participants]** representing occupational health and safety professionals across disciplines. The CE Program continued to strengthen collaborations with the Wisconsin State and Minnesota Associations of Occupational Health Nurses, the Impairment Without Disability Occupational Medicine physicians, and local chapters of the American Industrial Hygiene Association and the American Society of Safety Engineers, by collaborating on regularly scheduled professional development programs and events. **Geographically, the MCOHS CE programs extended to 50 states and 69 countries with 97% of our onsite participants and 25% of our online course participants representing our regional service area involving states of Minnesota, North Dakota, South Dakota and Wisconsin.**